ECONOMIC PERFORMANCE OF COFFEE AND PEPPER INTERCROPPING IN QUANG HIEP COMMUNE, CUMGAR DISTRICT, DAK LAK PROVINCE

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ABSTRACT

Coffee and pepper are key crops generating income and employment for farmers in the Central Highlands. The intercropping of the two crops has been practiced recently by farmers and this has initially shown to be a good production system. The study was designed to evaluate the economic performance of coffee and pepper intercropping in Quang Hiep commune, CuMgar district, Dak Lak province, and propose key recommendations to improve the economic performance of the system. In-depth interviews with 50 farm households were conducted, and evaluated using descriptive and comparative statistics. The results show that the average area of intercropping is estimated at about 1.5 ha/ farm household. On average, a hectare of intercropping produces 2.76 tons of coffee and 1.51 tons of pepper, generating an income of about 203 million VND/ha for households during the crop season 2014 - 2015. The system proved to be more economically efficient than the mono-system. Economic performance of the intercropping system was found to be different between households and depended on the production scale, irrigation status, seed quality, gender, ethnicity, and farmers' technical know-how. The production system now faces other obstacles, such as crop diseases and pests, changing weather, input and output market, and market information. Key recommendations to improve economic performance of coffee-pepper intercropping in Quang Hiep commune are proposed accordingly.

Keywords: Coffee, economic performance, intercropping, pepper, Quang Hiep.

Hiệu quả kinh tế mô hình trồng xen hồ tiêu và cà phê tại xã Quảng Hiệp, CưMgar, Đăk Lăk

TÓM TẮT

Cà phê và hồ tiêu là hai loại cây trồng chủ lực, tạo thu nhập và việc làm cho nông dân vùng Tây Nguyên. Xen canh cà phê với hồ tiêu là phương pháp đã được áp dụng gần đây và cũng đã chứng tỏ một mô hình sản xuất tốt. Nghiên cứu này nhằm đánh giá hiệu quả kinh tế của mô hình trồng xen canh cây cà phê và hồ tiêu tại xã Quảng Hiệp, huyện CuMgar, tỉnh Đắc Lắk và đề xuất một số giải pháp nhằm nâng cao hiệu quả kinh tế của mô hình này trong thời gian tới. Nghiên cứu này được thực hiện qua điều tra 50 hộ nông dân và phỏng vấn sâu với một số tác nhân. Các phương pháp chủ yếu sử dụng là thống kê mô tả, thống kê so sánh. Kết quả cho thấy quy mô sản xuất trung bình mỗi hộ khoảng 1,5 ha. Mỗi hec-ta trồng xen canh cho sản lượng 2,76 tấn cà phê và 1,51 tấn hồ tiêu, mang lại thu nhập khoảng 203 triệu đồng/ha cho hộ nông dân trong niên vụ 2014 - 2015. Mô hình trồng xen cà phê và hô tiêu cũng chứng tỏ là có hiệu quả kinh tế hơn là các mô hình trồng độc canh. Hiệu quả kinh tế của mô hình trồng xen canh cà phê và hồ tiêu khác nhau giữa các loại hộ và phụ thuộc vào quy mô sản xuất, điều kiện nước tưới, chất lượng hạt giống, giới và dân tộc của chủ hộ, cũng như hiểu biết kỹ thuật của nông dân. Mô hình trồng xen canh cũng chịu ảnh hưởng của các yếu tố bên ngoài khác như dịch bệnh cây trồng, thay đổi thời tiết, biến động thị trường đầu vào, đầu ra, thông tin thị trường. Trên cơ sở đó, các giải pháp đã được đề xuất nhằm nâng cao hiệu quả kinh tế của mô hình xen canh cà phê và hồ tiêu.

Từ khóa: Cà phê, hồ tiêu, hiệu quả kinh tế, Quảng Hiệp, trồng xen.

1. INTRODUCTION

Perennial industrial crop production has been become an important livelihood activity of farm households in Vietnam, especially coffee and pepper production in the Central Highlands region. In 2015, Vietnam had 2,486 thousand hectares of perennial industrial crops, of which coffee and pepper contributed about 30% of the total perennial crop area (GSO, 2016). In Dak Lak province, traditional farming practices of coffee and pepper have now been expanded from a mono-crop system (separating coffee and pepper) to an intercropping system, where coffee and pepper are grown together. This system is considered to have high economic potential (Institute of Engineering Sciences and Agriculture - Forest Highlands, 2011) and is considered to be a means for farmers to escape from poverty (Huy Hoang, 2014). CDC (2013) also mentions the advantages and disadvantages of intercropping coffee with pepper. In the Quang Hiep commune, coffee and pepper accounted for nearly half the total natural area in 2014, coffee and pepper intercropping (CPIC) has been practiced since 1999, and has been reported to play an important role in improving socio-economic status in the commune. It is believed that the expansion of the system is generally spontaneous where farmers work by their own experiences in intercropping coffee and pepper. This study was designed to evaluate the current economic performance and factors affecting economic performance of CPIC in Quang Hiep commune, to provide information for agricultural managements, extension centers as well as the local authority so that they can orient and help to develop this intercropping system in the future.

2. RESEARCH METHODS

2.1. Data collection

The secondary data relevant to CPIC in Quang Hiep commune, CuMgar district, Dak Lak province was gathered from the statistical Yearbook of Dak Lak province between 2012 and 2014, annual reports included: province, district and commune, and Provincial People's Communities. Other reports from books, newspapers, websites, and previous studies or thesis reports of similar topics were also collected.

Primary data was collected through surveys of 50 CPIC households, randomly stratified by production area, as normally differentiated by local people, which were classified into three groups of small (< 1 ha), medium (1 - 3 ha), and large (> 3 ha), as suggested by extension workers. In-depth interviews with the leaders of the commune were conducted with commune and village leaders, extension workers and 10 collectors who buy coffee and pepper from farmers.

2.2. Data analysis

Descriptive statistical analysis was applied with simple statistics such as means and growth rate, with the aids of tables and charts. Comparative statistics were employed with simple t-tests and F-tests for means comparison. The major criteria for financial analysis for farm households were costs, value added, and net farm income (EC, 1989; Farm Financial standards Council, 1997).

3. RESULTS AND DISCUSSIONS

3.1. Coffee and pepper intercropping in Quang Hiep commune

Intercropping is the growing of two or more crops simultaneously in the same field. The practice of relay intercropping involves planting a second crop after an initial crop has reached maturity, but before it is ready for harvest. According to Larry and Barbara (2001), one application of relay intercropping is to divide crops into two categories: the main component is the crop of primary importance and has the desired yields; the second crop, or secondary component, provides added economic and/or environmental benefits. The polyculture (multi cropping/ intercropping) is used commonly in agriculture. Ofori and Stern (1987) suggest that

growing two or more crops simultaneously is more efficient than monocropping for exploitation of limited resources. However, a major concern in using intercropping systems on infertile soils is the accelerated depletion of mineral nutrients when both crops are harvested. Coolman and Hoyt (1993) highlighted that when overlapping crops in space and time, the growth of two or more crops often results in decreased yields of both crops due to competition for limited essential resources. Any development of intercropping systems must evaluate the effects of competition on crop yields.

Coffee and pepper intercropping was first practiced in Quang Hiep commune in 1999 by a chairman of the commune, who also shared his experiences with other farmers. The intercropping area expanded quickly and reached 450 ha in 2014 (Table 1), accounting for about 18% of the total coffee and pepper areas in the commune. The total output production of pepper has increased significantly, from 742 tons to about 1400 tons during 2012 - 2014, where coffee production exhibited an unstable trend, with decreased volume in 2014, due to reductions in both area and yield.

3.2. Economic performance of coffee and pepper production in farm households

3.2.1. General information on farm households and the intercropping system

About three-fourths of the interviewed households are headed by men, with an average age of about 42 years old and 9 years of schooling (Table 2). On average, a household has 2.1 ha of cultivated land, of which the intercropping area is 1.5 ha. Almost all households have pumps and wells for coffee and pepper production, largely thanks to a national grip program in the commune.

Table 1. Selected indicators of coffee and pepper production in Quang Hiep commune
(2012 - 2014)

Indicators	2012	2013	2014	Comparison (%)	
				2013/2012	2014/2013
1.Total coffee and pepper area	2,259.5	2,340.5	2,540	103.58	108.52
Of which, intercropping area	225	335.5	450	149.11	134.13
2. Total production (tons)					
Coffee	5,490	6,985	6,680	127.22	95.63
Pepper	742	994	1,423	133.91	143.22

Sources: Statistics from Quang Hiep commune (2015)

Table 2. Characteristics of CPIC households in Quang Hiep commune

Indicators	Value
% households headed by men	76
Age of household heads (year)	41.5
Number of schooling years of household heads (year)	9
Experience with CPIC of households (year)	7
Total cultivated land area per household (ha)	2.1
CPIC area per household (ha)	1.5
Production capital per household (million VND)	165
Labor working in coffee and pepper production per household (people)	2.3

Source: Calculated from household survey, 2015

Table 3. Characteristics of CPIC gardens in farm households, by production scale

Items	Small (n = 14)	Medium (n = 31)	Large (n = 5)
1. Method (% households)			
Group	8	30	2
Intersection	20	32	8
2. Density (trees/ha)			
Coffee	950 - 1,000	900 - 1,000	900 - 950
Pepper	700 - 750	650 - 700	650 - 700
3. Age of intercropping garden (% household)			
Under 5 years	16	18	2
From 5 - 15 years	6	26	8
Over 15 years	6	18	0

Source: Calculated from household survey, 2015

Generally, two methods of intercropping coffee and pepper are now practiced in Quang Hiep commune, namely the group and intersection methods. The intersection method is a way that produces plants in 2 - 3 coffee rows to intercrop one pepper row (the pepper crop is cultivated at the intersection point of the coffee holes), where in the group method, small sub-areas of coffee and pepper are designed in the garden. Among interviewed households, large and small ones tend to choose the intersection method more often, where the medium sized households balanced between the two methods (Table 3).

Cropping density varied from about 900 - 1,000 coffee trees/ha and 650 - 750 pepper trees/ha (Table 3), however, small households tended to have a higher density, for example, reaching a maximum of 1000 coffee trees/ha and 750 pepper trees/ha whereas the large ones practiced lower density (Table 3), which is better, according to the commune extension worker. Nearly half of farm households have intercrop gardens aged from 5-15 years.

3.2.2. Production costs

Production costs of the intercropping garden were decomposed into two types, the depreciation cost of fixed assets and variable costs. Large households incurred the highest production costs, estimated at about 47 million VND/ha for the crop year 2014 - 2015 (Table 4). Fertilizer accounted for the largest part of production costs, at about 50% for all households. Medium and large households generally applied more fertilizer and water for their gardens.

Table 4. Production costs of coffee and pepper intercropping system, by production scale

Items	Farm size			All
	Small	Medium	Large	
1. Variable costs	37.1	41.1	41.6	40.1
Fertilizer	20.1	23.0	23.6	22.3
Watering	0.8	1.2	1.2	1.1
Pesticide	0.6	0.9	0.9	0.8
Hired labor	15.5	15.9	15.8	15.8
Others	0.1	0.1	0.1	0.1
2. Fixed costs	5.3	5.4	5.5	5.3
Total cost	42.3	46.5	47.1	45.4

Source: Calculated from household survey, 2015

Table 5. The average yields and total production of intercropping based on farm sizes

Indicator	Farm size			Average
	Small	Medium	Large	
1. Yield (tons/ha)				
Coffee	2.7	2.75	3	2.76
Pepper	1.47	1.52	1.55	1.51
2. Total productivity (tons/household)				
Coffee	1.43	4.5	10.1	4.20
Pepper	0.78	2.5	5.4	2.31

Source: Calculated from household survey, 2015

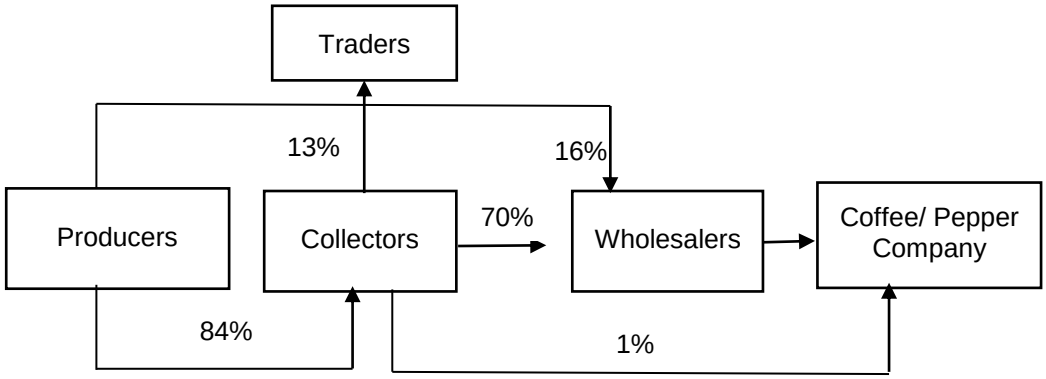

Figure 1. Marketing channel of coffee production of farm households in Quang Hiep commune

Sources: Household survey, in-depth interviews with collectors, wholesalers, 2015

3.2.3. Yield, production volume, and marketing of coffee and pepper

On average, a hectare of coffee and pepper intercropping produces 2.76 tons of coffee and 1.51 tons of pepper (Table 5). Large households achieved the highest yields, estimated at about 3 tons of coffee and 1.6 tons of pepper, largely thanks to higher levels of investments and more careful seed sourcing. Large farms were also found to often update information about diseases, quality fertilizers, and the best pesticides, and consult with local plant protection experts in cases of disease. With higher production areas and yields, large-scale farm households attained the highest volumes of production, with averages of about 10 tons of coffee and 5.4 tons of pepper in the 2014 - 2015 crop year (Table 5).

Almost all coffee and pepper produced (84%) go to local collectors, who reside in the commune and buy coffee and pepper from households to sell to wholesalers and traders. Most of the traders are located outside of the commune. There are two coffee companies, namely D'rao and Ea Pok ones, located in other communes and at the district center, but there is no pepper company in CuMgar district. Farmers prefer to sell their coffee and pepper to collectors in order to save transportation costs and get cash quickly, even if they sell at lower prices. In-depth interviews with village heads reveal that there are about 1-2 collectors in each village, which is convenient for farmers in selling their products.

About 16% of coffee production goes to wholesalers and comes mostly from larger farms with considerably higher production volumes

and higher quality (humidity, foreign matter, etc.), which is valued higher by wholesalers.

3.2.4. Economic performance of coffee and pepper intercropping

On average, a hectare of coffee and pepper intercropping generates a total value of about 374 million VND with 216 million VND of value added during the 2014 - 2015 crop year (Table 6). Larger production scales seem to generate higher economic performances in coffee and pepper intercropping, with total net family income/ha of large farm households estimated at about 237.8 million VND/ha, much higher the figures from small ones (Table 6).

In comparing the economic performances between the monocropping systems (i.e. coffee or pepper separately), it was shown that the intercropping system had a higher performance in terms of total revenues, value added, and net farm income. For example, net farm income from 1 ha of an intercropping system was estimated at about 202.7 million VND, much higher in comparison to a mono coffee cropping system (142 Million VND) and a mono pepper cropping system (48.8 million VND/ha) (Table 7).

3.3. Factors affecting the economic performance of coffee and pepper production

Infrastructure, crop disease, input and output prices, and weather are considered to be the most common factors that negatively affect crop production, as reported by all farmers (Figure 2). From data analysis, it was also found that the production scale and age of trees also influence the economic performance of the CPIC.

Infrastructure

Infrastructure was reported as one of the most important factors affecting coffee and pepper production, especially in terms of roads to transport coffee, electricity, and irrigation systems. Water was reported by about 54% of farmers as one of the impediments to coffee and pepper yields in the commune (Figure 2), especially during the dry season. Farmers have to use pumps to get water from wells, but in many cases three-phase electricity wire was not available, and the use of gasoline was also expensive. Coffee and pepper yields were shown to be statistically different between being watered and not (Table 8). As a result, higher NFI/IC ratios were seen in the gardens being watered. This also coincided with findings from Cheesman and Bennett (2015).

At the significant level of 5%, the test results illustrate that $t_{obs} > t_{crit}$. The alternative hypothesis, H_1 is accepted while the H_0 rejected. This means that the performance indicators are not the same between households with training and households without training. When the household heads are not trained, they do not apply modern techniques in production such as fertilizers, planting design, and disease prevention. They just implement by their experiences. Therefore, the yields of coffee and pepper are low.

Table 6. Economic performances of coffee and pepper intercropping, by production scale

Indicator	Unit	Farm size			Average
		Small	Medium	Large	
Total revenue (TR)	Mil. VND	355.2	375.2	415	373.6
Intermediate cost (IC)	Mil. VND	154.2	158.4	161.2	157.5
Value added (VA)	Mil. VND	201.0	216.8	253.8	216.1
Net farm Income (NFI)	Mil. VND	191.0	202.3	237.8	202.7
TR/IC		2.16	2.17	2.34	2.2
NFI/IC		1.24	1.28	1.48	1.3

Source: Calculated from household survey, 2015

Table 7. The economic performances of coffee and pepper by production system (per ha)

Indicator	Farm type		
	Only coffee	Only pepper	Intercropping
TR (Mil. VND)	128.5	288	373.58
IC (Mil. VND)	68	135.25	157.50
VA (Mil. VND)	60.5	152.75	216.08
NFI (Mil. VND)	48.8	141.75	202.69
TR/IC	1.61	1.95	2.18
NFI/IC	0.72	1.05	1.29

Source: Calculated from household survey, 2015

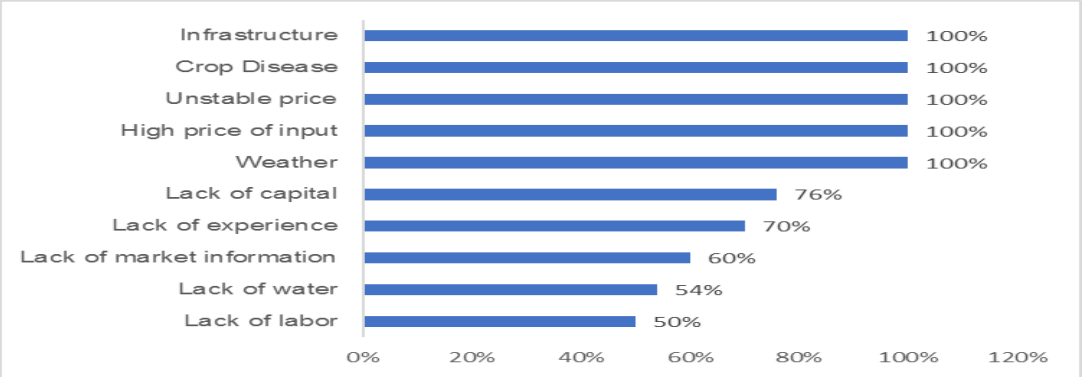

Figure 2. Constraints in coffee and pepper production, as perceived by farmers

Source: Calculated from household survey, 2015

Table 8. Test results of selected factors on coffee and pepper yields of intercropping system performance

Factors	Coffee yield	Pepper yield	NFI/IC
Irrigation			
Crop is watered	2.8	1.52	1.21
Crop is not watered	2.59	1.4	0.85
Difference	0.21**	0.12***	0.36***
Production scale			
Small	2.7	1.47	1.0
Medium	2.8	1.52	1.26
Large	3	1.55	1.5
F-stat	8.4***	7.03***	26.6***
Seed selection			
Bought from seed company/center	2.94	1.53	1.36
Produced by farmers	2.7	1.48	1.1
Difference	0.24***	0.05*	0.26***
Training of famers			
Farmers were trained	2.85	1.54	1.35
Farmers were not trained	2.72	1.48	1.09
Difference	0.13**	0.06**	0.26***

*Note: *, **, ***: significant at 10%, 5%, 1%, respectively*
Source: Calculated from household survey, 2015

Production scale

A larger production scale was found to have a better economic performance than a smaller scale (Table 8) for saving production costs, especially labor costs in caring and harvesting. Moreover, the large-scale farmers often use better techniques and good machines so that labor is saved, and their gardens tend to be attacked by diseases and pests less often than in small gardens. It was revealed during the survey that small scale farmers often do not invest carefully and they reasoned that gross output from coffee and pepper was not very significant. They did not have much money to invest in their farms, but if their production area expanded in the future, they would invest more.

Crop disease and insects, and weather

Serious crop diseases and pests such as coffee rust, Coccus viridis (Green), cicada infestations, nematodes (yellow leaf), mealy bugs, and stem borers caused yield damage. No data was available to show the negative impact of crop diseases and pests on crop yield but farmers expressed their serious concerns on the matter. Farmers reported that they could still manage these problems but it was difficult, especially with aging crops, degraded soil, and abnormal weather (drought and erratic rain). Abnormal weather was also reported to contribute to crop diseases by all farmers (Figure 2). At the time of the study, there was no plant protection specialist in the commune and farmers had to go to the district to consult with extension specialist when the crops got diseases.

Inputs

Coffee and pepper producers in Quang Hiep commune are heavily reliant on fertilizer usage and gasoline. These input prices are high and volatility was cited as a major concern by the farmers. Among inputs, seed quality was cited as an issue in production. About 90% of farmers either bought coffee and pepper seeds from other households or produced the seeds themselves, and the selection of seeds is based on only size (big) and appearance (looks good, no scratches, no evidence of pests/insects, good color), without knowing the seed quality. About 10% of farmers bought seed from the seed center, seed company, or EaKmart institution, where seed is selected quite carefully. As a result, seed bought from seed a company/center provided higher yields (Table 8).

Farmers' knowledge and expertise in production

Coffee and pepper intercropping is still a new technique to Quang Hiep farmers, and knowledge about planning, caring for, and harvesting is required. A training course on coffee and pepper sustainable production was held in 2014, and farmers were also trained four times about technical planning, caring for, using fertilizers, using pesticides, harvesting and processing. Some companies such as Viet Nhat Fertilizer Cooperation, Binh Dien, Hoa Cuong, Nhat Loc Phat provide trial products and share their experience with farmers. According to the survey data, just about 50% of farmers participated in the trainings. Testing results also showed that the economic performance of the CPIC was different among farmers who attended training and those who did not (Table 8). It was also observed that trained farmers usually apply the intersection method, while non-trained farmers applied the method of intercropping coffee and pepper. According to the survey data, 24% of farm households harvested coffee where the rate of ripened berries was under 50%

Output prices and information

Unstable price of coffee beans is probably one of the largest concerns of farmers, which varied over years and seasons. Two-thirds of farmers did not have full information on the coffee market, mostly depending on local traders. Information from the internet, as reported, had limited value to farmers, as they depend on local traders who buy coffee from farmers. No formal linkage between farmers and traders/buyers was found among the farmers.

Gender, ethnicity, and others

About three-fourths of farm households are headed by men. Coffee and pepper production is

usually considered to have heavy tasks (land preparation, watering, caring, harvesting, etc.). Machines and other equipment (pumps, transportation vehicles, and others) used in production also require strength that women may lack so male- headed households are expected to have better performance in production. It was revealed from interviews with the extension workers that most participants attending trainings are male, which was also confirmed by the test results (Table 9). It is worth noting that ethnicity also has implication to economic performance in production, with Kinh farmers having better economic performance than other farm households (Table 9).

Farmers also reported that they lacked capital, which constrained them in investing in their garden or forced them to borrow from an informal financial system with high interest rates. Crop age also influenced productivity, with peaks attained at about 12-13 years for pepper and 13-15 years for coffee (Figure 3). This suggests that famers might need to improve their techniques to slow down the decreasing rate of yields after peak years.

3.4. Recommendations for improvement of economic performance of coffee and pepper intercropping in Quang Hiep Commune

Production plan of coffee and pepper intercropping system in the commune

Land for production is limited in Quang Hiep commune, so the intercropping of coffee could be a solution. Leaders in Quang Hiep commune have developed a master plan for coffee and pepper production to the year 2020, by which the total area of coffee and pepper intercropping is projected to be about 450 ha in 2016 and 460 ha in 2020. The plan is not only based on available area for production, but also depends on market conditions.

Table 9. Differences in coffee and pepper intercropping performance by gender and ethnicity

Factors	Coffee yield	Pepper yield	NFI/IC
Gender of household head			
Male	2.81	1.55	1.23
Female	2.67	1.44	0.9
Difference	0.14**	0.11*	0.33***
Ethnicity			
Kinh	2.8	1.51	1.22
Others	2.6	1.44	0.92
Differences	*0.2***	*0.07**	*0.3****

*Note: *, **, ***: significant at10%, 5%, and 1%, respectively*
Source: Calculated from household survey (2015)

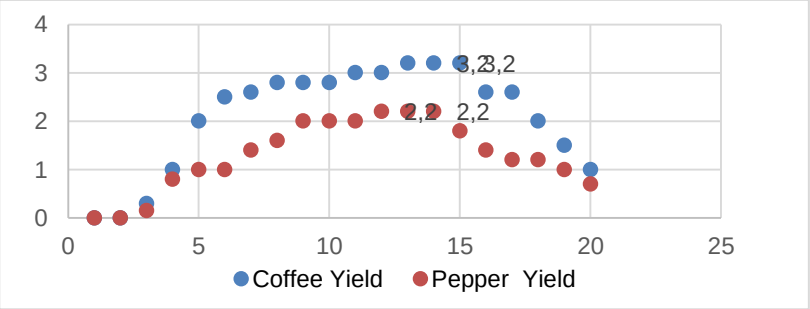

Figure 3. The yields of coffee and pepper products in intercropping by year

Sources: Calculated from data, 2015

Table 10. The Master Plan of Quang Hiep commune for the period of 2016 - 2020

No	Items	2016	2020
1	Perennial industrial crop area (ha)	2,572	2,630
	Coffee and pepper intercropping (ha)	450	460
2	Yield (ton/ha)		-
	Coffee	3.2	3.5
	Pepper	2.4	3.2

Source: Calculated from household surve, 2015

Recommendations

Improving farmers' knowledge and techniques on intercropping coffee and pepper: As mentioned above, intercropping is new to farmers and most of them practice based on their own knowledge. Therefore, they often lack the knowledge and skills in planting, caring for, and harvesting their crops. Future training should focus on the construction period (plant density and methods of intercropping), and the harvesting period (using fertilizer, detecting insects and disease prevention, harvesting methods (e.g. having a rate of over 80% ripened berries in order to improve product price and value), as well as preventive measures against crop diseases and insects, especially for pepper). Trainings also should focus more on female and ethnic farmers.

Increasing investment and encouraging use of quality seed: Economic performance of CPIC is greatly influenced by seed quality. Hence, local authorities should create good conditions for farmers to approach and use new, quality seed. Also, technical guidance on seed selection for intercropping should be provided. At the time of surveying, there was no seed provider inside the commune, so private seed providers should be encouraged to set up. During training, recommendations on seed selection as well as encouraging farmers to use quality and certified seed should be addressed. Pillars for pepper should replace timber pillars for higher effectiveness and lower costs, as well as exhausting timer sources.

Infrastructure improvement and other supports from local government and line agencies: Public investment in basic infrastructure, especially irrigation systems, is recommended. Local authorities might practice activities to support farmers in finding water sources, or develop measures to save water in the dry season. Extension services, as the abovementioned, should focus more on the intercropping system. The local government could also be an intermediate in setting up linkages between farmers and buyers in order to mitigate market risks for farmers. Coffee prices, other input prices, and other market information should be designed and disseminated effectively and efficiently to farmers.

Improve farmers' capability in production and negotiation with traders: At the time of surveying, crop production at farm households faced a number of difficulties because the high costs as well as the low product prices. Small farms with low volumes of production usually have to sell at lower prices. Therefore, improving the production capacity (land and capital) and the negotiation capability for farmers are necessary. One possible solution is to set up a region for coffee and pepper intercropping (e.g. probably more than 20 ha) such that the volume is high enough to get better prices. Farmers might be organized into groups to have a better voice in negotiating output and input prices, especially to escape the price squeeze of collectors or traders.

4. CONCLUSION

The coffee and pepper intercropping system has been practiced widely in Quang Hiep commune with rapid increases in terms of area,

reaching 450 hectares in 2014, producing about 6,680 tons of coffee and 1,423 tons of pepper. The system has become a key cropping system for local economic development. The study showed that the average area of intercropping reached 1.5 ha/ farm household. On average, income returned to household was estimated at about 203 million VND/ha in the 2014-2015 crop season. There was also evidence that the intercropping system is more economically efficient than the mono-system. The economic performance of the intercropping system was found to be different between households and depended on production scale, irrigation status, seed quality, gender, ethnicity. and the farmers' knowledge. The production system now faces other challenges, such as a lack of water resources, farmers' technical know-how, crop diseases and pests, changing weather, finances, and market information.

We proposed a set of recommendations to improve economic performance of the coffee-pepper intercropping in Quang Hiep commune, namely improving the farmers' knowledge and techniques on intercropping of coffee and pepper, increasing investments, encouraging the use of quality seed, improving infrastructure and other support from local government and line agencies, and improving the farmers' capability in production and negotiation with traders. And there is a need to conduct a research on the effectiveness and economic performance of the system over a longer span of time. Advantages and disadvantage as well as potentials to expand the system should also be further studied.

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